

## IN THE CLAIMS:

The text of all pending claims are set forth below. Cancelled and withdrawn claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~strikethrough~~. The status of each claim is indicated with one of (original), (currently amended), (previously amended), (cancelled), (withdrawn), (new), (previously added), (reinstated - formerly claim #), (previously reinstated), (re-presented - formerly dependent claim #) or, (previously re-presented).

Please CANCEL claim 2-10 in accordance with the following:

1. (original) Bidirectional signal processing method for the robust parallel transmission of digital transmit data streams in regular and singular radio channels of a multiple input-multiple output radio transmission system (MIMO system) having  $n_T$  transmit antennas and  $n_R$  receive antennas with a rank-adaptive matching of the data transmission rate to the total currently available channel capacity while keeping constant the maximum transmit power  $P_{tot}$  as the sum of all subchannel powers  $P_i$  where  $i = 1 \dots \min(n_T, n_R)$ , with the rank-adaptive matching of the data transmission rate in respect of the channel matrix  $H$  to the currently available channel capacity being performed by means of a variation, continuously adjusted to the current channel behavior, of  $n_d$  currently used subchannels and the spectral efficiency  $K$  of the at least one selected coding and modulation method, comprising the following method steps which are to be cyclically repeated:

I) Determination of the channel matrix  $H$  on the transmit and the receive side of the MIMO system according to

$$y = Hx + n \quad (1)$$

where  $y$  = receive vector

$x$  = transmit vector

$n$  = noise vector

II) Singular value decomposition  $SVD(H) = UDV^H$  of the known channel matrix  $H$  with the maximum rank ( $n_T \times n_R$ ) on the transmit side and the receive side of the MIMO system for determining the unitary transformation matrices  $U$  and  $V$  as well as the diagonal matrix  $D$  containing the ordered singular values  $\sqrt{\lambda_i}$  derived from the eigenvalues  $\lambda_i$  of the subchannels on the left main diagonal.

III) Modification of the transmit data vector  $x$  on the transmit side of the MIMO system by means of a linear matrix-vector multiplication according to

$$\mathbf{x} = \frac{1}{\gamma} \mathbf{V} \mathbf{Q} \mathbf{d} \quad (2)$$

where  $\gamma = \sqrt{\frac{\sum_{i=1}^{n_d} P_i}{P_{tot}}} =$  amplification factor for limiting the total transmit power  $P_{tot}$ ,

where  $\mathbf{V}$  = right unitary transformation matrix according to II)

where  $\mathbf{Q}$  = diagonal transmit matrix containing the values  $\sqrt{P_i}$  on the left main diagonal

and

where  $\mathbf{d}$  = current transmit data vector containing the variable length  $n_d \leq \min(n_T, n_R)$

from the support of  $n_d$  subchannels for the parallel transmission of the transmit data streams

IV) Multiplication of the currently received transmit data vector  $\mathbf{d}'$  on the receive side of the MIMO system where  $\gamma \mathbf{U}^H$ , from which through insertion according to I) and II) it follows

$$\mathbf{d}^* = \gamma \mathbf{U}^H \mathbf{y} = \mathbf{D} \cdot \mathbf{Q} \cdot \mathbf{d} + \gamma \mathbf{U}^H \mathbf{n} \quad (3)$$

V) Determination of the  $n_d$  components  $d_k^*$  of the currently received, modified transmit data vector  $\mathbf{d}^*$  from IV) according to

$$d_k^* = \sqrt{\lambda_k \cdot P_k \cdot d_k + \gamma \cdot \tilde{n}_k} \quad (4)$$

where  $k = 1 \dots n_d$

VI) Selection of the subchannel powers  $P_i$  according to

a) with an optimal rank-adaptive support for all subchannels  $P_i > 0$  based on the water-filling principle WF according to

$$P_i = \left( \mu - \frac{\sigma_n^2}{\lambda_i} \right)^+ \quad (5)$$

where  $(a)^+ = 0$  for  $a = 0$  and  $(a)^+ = a$  for  $a \neq 0$

where  $\mu$  = fill factor which is chosen so that  $\sum_{i=1}^{n_d} P_i = P_{tot} \Rightarrow \gamma = 1$

where  $\sigma_n^2$  = noise power at the receiver (normalizable to 1)

which yields the number  $n_d$  of the currently usable subchannels for a modification of the current transmit data vector  $\mathbf{d}$  according to

$$n_d = |\{i : P_i > 0\}| \quad (6)$$

and which yields a variable signal-to-noise ratio according to

$$SNR_k^{WF} = \frac{\lambda_i \cdot P_i}{\sigma_n^2} \quad (7)$$

or

**b)** with a suboptimal rank-adaptive support for all subchannels according to the adaptive channel inversion principle ACI where  $\mathbf{DQ} = \mathbf{I}$  where  $\mathbf{I}$  = unity matrix for a complete interference cancellation according to

$$P_i = \frac{1}{\lambda_i}, \quad (8)$$

where the number  $n_d$  of the currently usable subchannels is selected for a modification of the current transmit data vector  $\mathbf{d}$  such that the spectral efficiency  $K$  of the transmission is maximized and a constant signal-to-noise ratio is produced according to

$$SNR_k^{ACI} = \frac{P_{tot}}{\sigma^2 \sum_{i=1}^{n_d} \frac{1}{\lambda_i}} \quad (9)$$

**VII)** Selection of the optimal coding and modulation method based on the determined signal-to-noise ratio  $SNR_k^{WF}$  or  $SNR_k^{ACI}$  with specification of a bit error rate BER to be complied with, where

in case **a)** of the optimal rank-adaptive channel support, the optimal coding and modulation method is selected in each case for each of the  $n_d$  active subchannels or

in case **b)** of the suboptimal rank-adaptive channel support, a common coding and modulation method is selected for all  $n_d$  active subchannels.

Claims 2-10 (cancelled)